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(54) Title: ALKYL GLUCOSIDE, ITS USE FOR CLEANING PURPOSES, AND CLEANING COMPOSITION

(57) Abstract

In an alkyl glucoside of the formula (I): $RCH_2O(G)_xH$, R is an alkyl group having a total of 8-12 carbon atoms and containing 2-4 groups of formula $-CH(CH_3)-$ in its carbon chain; G is a monosaccharide residue; and x is 1-4. The use of the alkyl glucoside as a surfactant in the cleaning of hard surfaces is also disclosed. A composition containing an alkyl glucoside of formula (I), a complexing agent and a solubiliser is further described.

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ALKYL GLUCOSIDE, ITS USE FOR CLEANING PURPOSES, AND CLEANING COMPOSITION

This invention relates to an alkyl glucoside in which the alkyl group is methyl-branched, as well as the use of the alkyl glucoside as a surfactant in the cleaning of hard surfaces. The invention also concerns a cleaning composition in which the alkyl glucoside is combined with a solubiliser and preferably also with a complexing agent.

In recent years, attention has focused on alkyl glucosides, since these have proved to be more easily biodegradable than other non-ionic surfactants, such as ethylene oxide adducts of fatty alcohols. US Patent Specification 3,839,318 thus describes the production of alkyl glucosides and alkyl oligosaccharides, such as n-octyl glucoside, n-hexyl glucoside, n-decyl glucoside, n-dodecyl glucoside, isodecyl glucoside, isoundecyl glucoside, isotridecyl glucoside and the corresponding oligosaccharides. The United States Stationary Invention Registration H171 states that alkyl glucosides of formulae $R(OG)$ and $R(OG)_x$ are excellent surfactants. In these formulae, R is an alkyl or alkenyl group which is branched at the second carbon atom or at a higher carbon atom, the branch being selected from the group methyl, ethyl, isopropyl, n-propyl, butyl, pentyl, hexyl and mixtures thereof, provided that R contains from about 7 to about 30 carbon atoms; G is a saccharide group selected from the group glucose, fructose, mannose, galactose, talose, allose, altrose, idose, arabinose, xylose, lyxose, ribose and mixtures thereof; and x is 2 or more. Example 1 contains a description of the production of two product mixtures substantially made up of 2-ethylhexyl glucoside and isooctyl glucoside, respectively.

DE 20 36 472, EP 306 650, EP 306 651 and EP 366 652, inter alia, also describe alkyl glucosides.

Even though alkyl glucosides generally are easily biodegradable, they are only used to a limited extent in many ranges of application, such as the cleaning of hard surfaces, since they are too high-foaming and/or have too poor a cleaning power. It is therefore a desideratum to provide non-ionic surfactants which are about as easily biodegradable, but which have a better cleaning effect on hard surfaces and/or are more low-foaming than known alkyl glucosides.

According to the present invention, it has now surprisingly been found that an alkyl glucoside of formula

$$RCH_2O(G)_xH \qquad (I)$$

wherein R is an alkyl group having a total of 8-12 carbon atoms and containing 2-4 groups of formula $-CH(CH_3)-$ in its carbon chain, G is a monosaccharide residue, and x is 1-4, is advantageously used as a surfactant in compositions for cleaning hard surfaces. The alkyl glucoside of formula I shows good cleaning and wetting properties, as well as low foaming compared with other alcohols of approximately the same chain length. In addition, the alkyl glucoside has proved to be easily degradable and have low biotoxicity. Tests have not shown any skin irritations caused by the alkyl glucosides. Preferably, there are 2 or 3 methyl groups. Compounds in which R contains 9 or 10 carbon atoms and x is 1 or 2 are especially preferred, having a good cleaning power and being comparatively easy to produce.

The compounds according to the invention can be produced in conventional manner by reacting an alcohol of formula

$$RCH_2OH \qquad (II)$$

wherein R is as indicated above, with a monosaccharide in the presence of an acid catalyst, the molar ratio of the alcohol to the monosaccharide being 2:1-80:1. The catalyst may be an inorganic or organic acid. The reaction is per-

formed under vacuum at 90-120°C for about 1-4 h. Conveniently, the resulting reaction mixture is first filtered and then neutralised with an organic and/or an inorganic base, whereupon excess alcohol is carefully removed e.g. by distillation, if so desired.

The alcohols of formula (I) can be produced in conventional manner by condensing propene, butene or mixtures thereof, whereupon the di-, tri- or tetramers obtained are prolonged with a carbon atom by the oxoprocess. The resulting aldehydes may then easily be converted to the corresponding alcohols. The alcohols obtained form a complex mixture of methyl-branched structures, although some ethyl substituents may be present. The amount of quaternary carbon found in the carbon chain is very small, and alcohols containing quaternary carbon are to be regarded as impurities not encompassed by the invention. Examples of suitable alcohols are Exxal 9, Exxal 10, Exxal 11, Exxal 12 and Exxal 13, all sold by Exxon Chemical. The monosaccharide used as reactant suitably consists of pentose and hexose. Specific examples of monosaccharides used in the production of the inventive glucosides are glucose, mannose, galactose, talose, allose, altrose, idose, arabinose, xylose, ribose and lyxose. Glucose is usually preferred for commercial reasons.

The alkyl glucosides according to the invention are suitable for use in compositions for cleaning hard surfaces, e.g. for degreasing such surfaces or washing up. Excellent results are obtained in the degreasing of lacquered or unlacquered metal surfaces. Apart from the inventive alkyl glucoside, these compositions preferably contain a water-soluble solubiliser and suitably contain a complexing agent.

Examples of solubilisers are alkyl ether polyalkylene glycol, such as monobutyl diethylene glycol; glycols, such as diethylene glycol, dipropylene glycol and propylene glycol; alcohols, such as ethanol, propanol and isopropanol; alkyl glucosides in which the alkyl group has

4-8 carbon atoms; and/or tertiary or quaternary amine alkoxylates in which the alkyl group, which may be straight or branched, saturated or unsaturated, has 8-20 carbon atoms and in which 6-30 mol of alkylene oxide is added per mol of amine. Preferably, 50-100 mol per cent of the added alkylene oxide consists of ethylene oxide, the remainder preferably consisting of propylene oxide or a mixture of propylene oxide and butylene oxide. The different alkylene oxides can be added randomly or in blocks. If the cleaning composition should be exceptionally low-foaming, the alkylene oxide chain conveniently ends with an addition of 1-5 mol of propylene oxide and/or butylene oxide. The ratio of the solubiliser to the inventive alkyl glucoside is usually 1:10-5:1, preferably 1:3-3:1.

The complexing agent may be a conventional inorganic or organic agent, such as an inorganic phosphate or NTA, EDTA, citric acid or a polycarboxylate. The amount added may vary from nothing at all to 300% by weight of the inventive alkyl glucoside. Preferably, the quantitative ratio of the complexing agent to the alkyl glucoside is 1:10-2:1.

The cleaning compositions may further contain other additives, such as pH-adjusting agents, antifoaming agents, enzymes, other surfactants and scents. The compositions are usually aqueous and in the form of emulsions, microemulsions or solutions.

The invention will now be further illustrated by a few Examples.

Example 1

An alkyl glucoside was produced by reacting 2.6 mol of an alcohol (Exxal 9) of formula (II), wherein R is a C_8 alkyl having a methyl substitution of about 2 (average value), with 0.4 mol of glucose in the presence of 0.015 mol of sulphuric acid as catalyst at 110°C and 70 mbar. The reaction was interrupted after 105 min. The resulting product mixture was treated by distilling off excess alcohol under vacuum. The yield was 105 g, consisting of 60%

of C_9-branched alkyl monoglucoside, 15% of C_9-branched alkyl diglucoside and a residue of higher oligomers. The glucosides had an average degree of polymerisation (DP) of about 1.5. The structure was determined by gas chromatography, mass spectrometry and NMR.

Example 2

An alkyl glucoside was produced by reacting 7.6 mol of an alcohol (Exxal 10) of formula (II), wherein R is a C_9 alkyl having a methyl substitution of about 2.2 (average value), with 1.2 mol of glucose in the presence of 0.015 mol of sulphuric acid as catalyst at 90-111°C and 100 mbar. The reaction was interrupted after 120 min. The reaction mixture was treated by distilling off excess alcohol under high vacuum. The yield was 278 g, consisting of 60% of monoglucoside, 12% of diglucoside and a residue of higher oligomers. The glucosides had an average DP of 1.6.

Example 3

Here, 20 ml of each of the cleaning compositions below, diluted with 10 parts by weight of water per part by weight of the composition, was applied on a vertically arranged iron sheet soiled with mineral oils, soot, salts and clay. After application, the coated surface was rinsed with water without any mechanical treatment.

Components	Composition, % by weight						
	1	2	A	B	C	D	E
Glucoside (Example 1)	5						
Glucoside (Example 2)		5					
Glucoside A			5				
Glucoside B				5			
Glucoside C					5		
Glucoside D						5	
Butyldiethylene glycol			11	11	11	11	11
Quaternary ethoxylated fatty amine (Berol 555)	4	4					
NTA	5	5	3	3	3	3	5
Water	86	86	81	81	81	81	84

Glucoside A = 2-ethylhexyl-O(G)$_x$H
Glucoside B = isooctyl-O(G)$_x$H
Glucoside C = n-dodecyl/n-tetradecyl glucoside (APG-600, Henkel)
Glucoside D = n-decyl glucoside (Lutensol GD-70, BASF)
wherein G = glucoside residue and x = 1.5 (average value).

The attained cleaning effect was assessed with respect to the area of the cleaned surface, as well as its actual cleanness, the figure 1 indicating no improvement and the figure 10 indicating a perfectly clean surface. The following results were obtained.

Composition	Cleaned surface, cm^2	Cleanness
1	112	6
2	144	8
A	0	1
B	80	4
C	48	6
D	72	6
E	0	1

The foaming of the different ready-to-use solutions was measured according to Ross-Miles ASTM D 1173-53. The following results were obtained.

Composition	Foam height, mm	
	Instantaneously	After 5 min
1	5	0
2	8	0
A	7	0
B	20	3
C	67	63
D	46	45

It is evident from these results that the alkyl glucosides according to the invention show an excellent cleaning power and are clearly superior to alkyl glucosides having a straight carbon chain with 10-14 carbon atoms, while at the same time having an acceptable degree of foaming. The composition containing alkyl glucosides having an alkyl group with 8 carbon atoms showed an unsatisfactory cleaning power.

C L A I M S

1. The use of an alkyl glucoside of the general formula

$$RCH_2O(G)_xH \quad (I)$$

wherein R is an alkyl group having a total of 8-12 carbon atoms and containing 2-4 groups of formula $-CH(CH_3)-$ in its carbon chain; G is a monosaccharide residue; and x is 1-4, as a surfactant for cleaning hard surfaces.

2. Use as set forth in claim 1, **characterised** in that R is an alkyl group having 9 or 10 carbon atoms.

3. Use as set forth in claim 1 or 2, **characterised** in that R has a methyl substitution of 2 or 3.

4. Use as set forth in claim 1, 2 or 3, **characterised** in that G is a glucose residue.

5. Use as set forth in any one of claims 1-4, **characterised** in that x is 1 or 2.

6. Use as set forth in claims 1-5 of the alkyl glucoside of formula (I) as a surfactant in a cleaning composition for degreasing lacquered or unlacquered metal surfaces.

7. A cleaning composition, **characterised** in that it contains, in addition to the alkyl glucoside of formula (I), a water-soluble solubiliser and, optionally, an organic or inorganic complexing agent.

8. A cleaning composition as set forth in claim 7, **characterised** in that the solubiliser consists of alkyl ether polyglycols, glycols, alcohols and/or tertiary and/or quaternary alkylamine alkoxylates.

9. A cleaning composition as set forth in any one of claims 6-8, **characterised** in it contains a solubiliser in an amount of 1:3-3:1 based on the weight of

the alkyl glucoside, and a complexing agent in an amount of 1:10-2:1 based on the weight of the alkyl glucoside.

10. An alkyl glucoside of the general formula

$$RCH_2O(G)_xH \qquad (I)$$

wherein R is an alkyl group having a total of 8-12 carbon atoms and containing 2-4 groups of formula $-CH(CH_3)-$ in its carbon chain; G is a monosaccharide residue; and x is 1-4.

INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE 94/00198

A. CLASSIFICATION OF SUBJECT MATTER

IPC5: C11D 1/66
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC5: C11D, C07H

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US, A, 3839318 (RICHARD C. MANSFIELD), 1 October 1974 (01.10.74) --	1-10
A	DE, B2, 2036472 (ATLAS CHEMICAL INDUSTRIES INC.), 7 December 1978 (07.12.78) --	1-10

☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

* Special categories of cited documents:
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INTERNATIONAL SEARCH REPORT

Information on patent family members

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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US-A- 3839318	01/10/74	NONE	
DE-B2- 2036472	07/12/78	FR-A- 2055596	07/05/71
		GB-A- 1277516	14/06/72
		US-A- 3772269	13/11/73